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# Employment impacts of decarbonizing the economy: An alternative method between I-O analysis and CGE modelling

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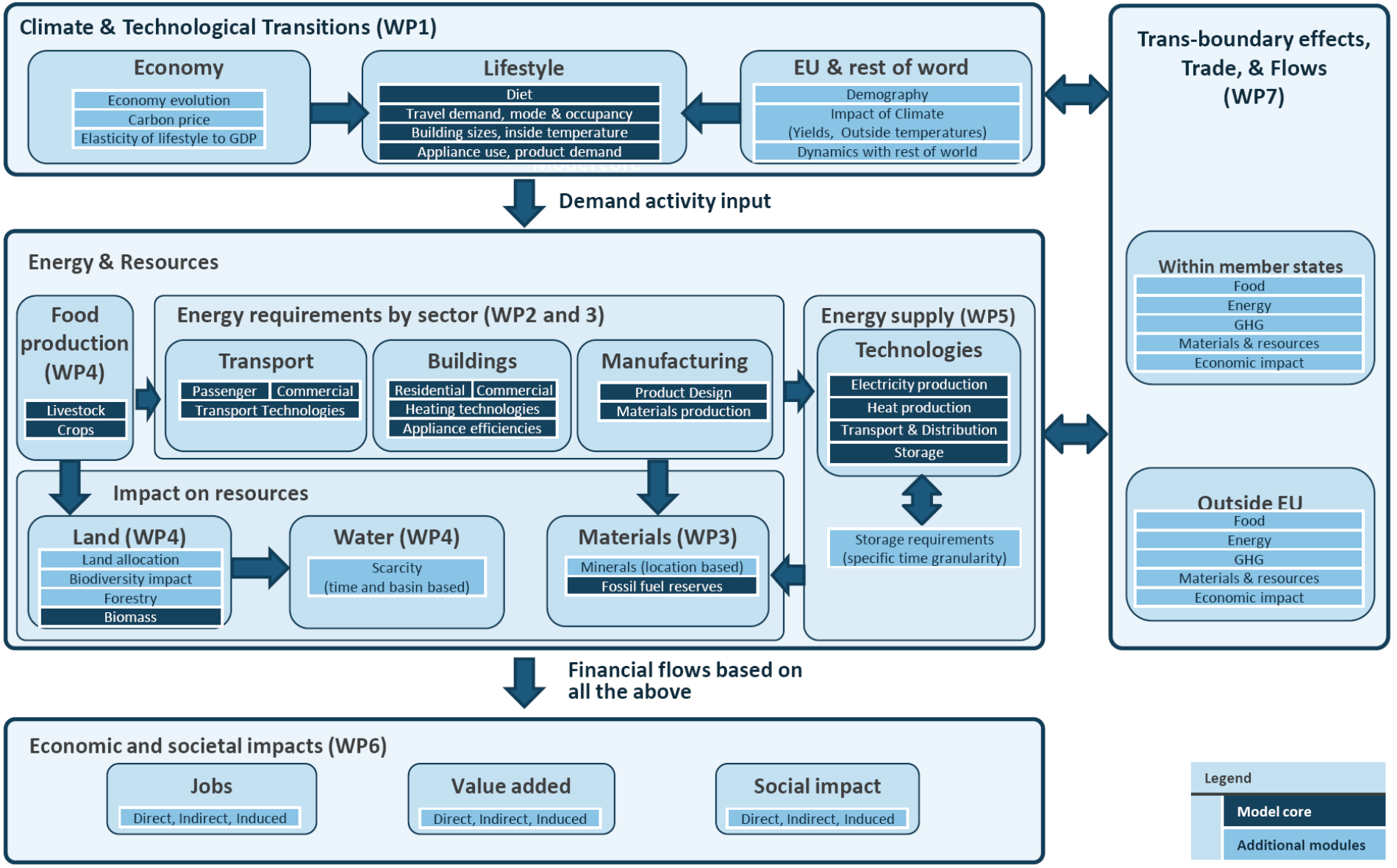
# Context: EUCalc Project

- EU Calculator: To explore pathways toward sustainable societies
- Different possible trajectories to achieve the same GHG-emission reduction target
- Different impacts on environment, society, economy
- Objective: To provide decision-makers an accessible modelling solution to better evaluate the impact of policies
- User-based simulation: online calculator
  - *Swiss Energyscope*
  - *Global calculator*

# EUCalc Project Structure



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# Challenges and motivation

- Study potential large economic transition, economy in 2050
  → Standard Input-Output Analysis not suited
- CGE model? Not possible because of:
  - Coupling issues
  - Inconsistencies between users choice and general equilibrium

→ Need for an alternative method between I-O and CGE

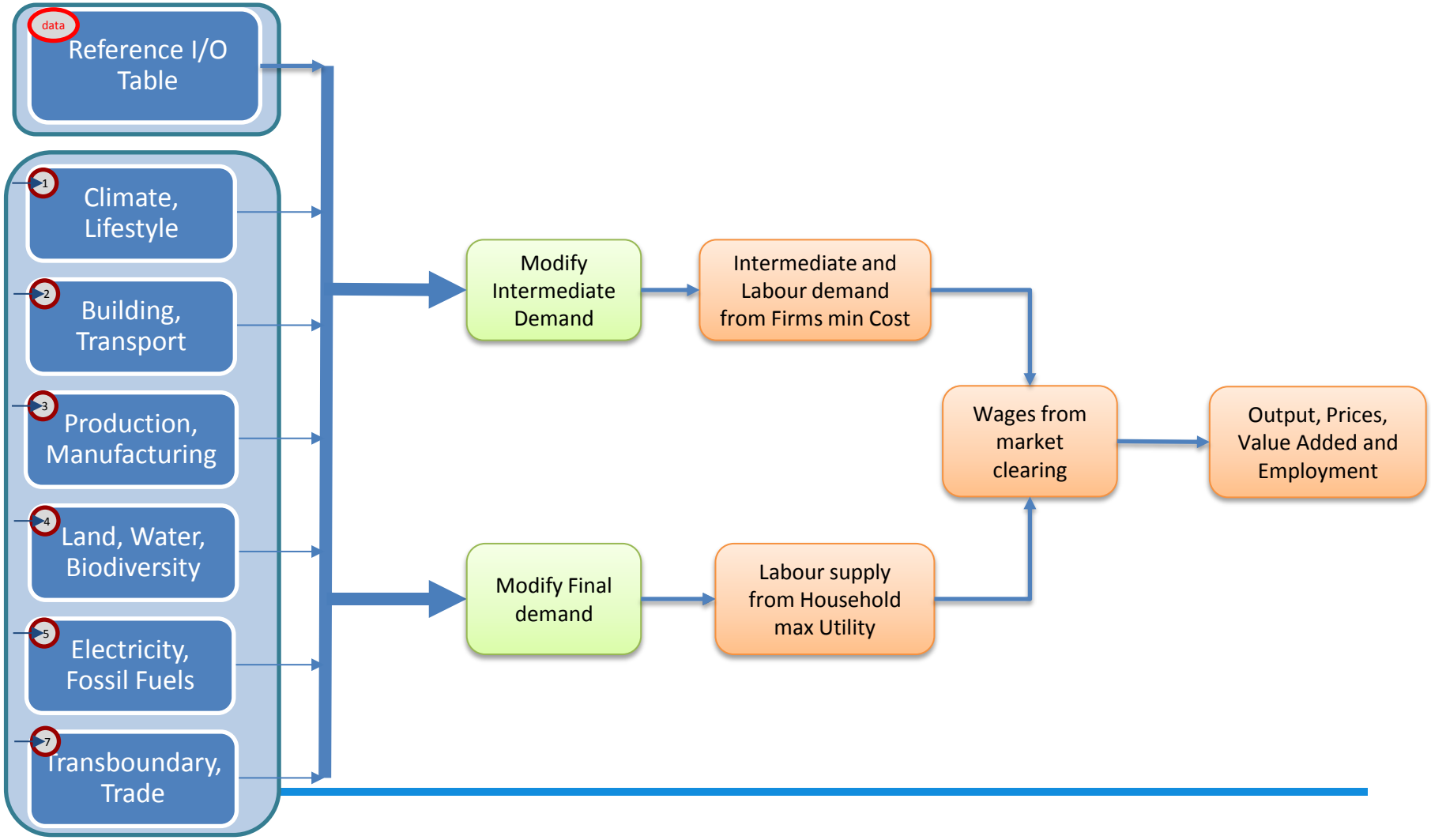
- Modification of intermediate and final demand as in I-O analysis
- Macroeconomic description of firms, consumers, government, labour markets, etc.

# Representation of the economy

- 37 sectors (GTAP database)
- Agriculture:
  - Crops & Vegetables
  - Animal products
- Energy:
  - Coal
  - Crude oil
  - Petroleum products
  - Gas
  - Electricity distribution
  - 11 Electricity production

| Id | EUCalc sector |
|---|---|
| 1 | Crops & Vegetables |
| 2 | Animal products |
| 3 | Forestry |
| 4 | Coal |
| 5 | Crude Oil |
| 6 | Petroleum products |
| 7 | Gas |
| 8 | Mining (Uranium) |
| 9 | Electricity distribution |
| 10 | Nuclear BL |
| 11 | Coal BL |
| 12 | Gas BL |
| 13 | Wind BL |
| 14 | Hydro BL |
| 15 | Oil BL |
| 16 | Other BL |
| 17 | Gas P |
| 18 | Hydro P |
| 19 | Oil P |
| 20 | Solar P |
| 21 | Gas, Hot Water % Steam |
| 22 | Water |
| 23 | Construction |
| 24 | Land Transport |
| 25 | Water Transport |
| 26 | Air Transport |
| 27 | Iron and steel |
| 28 | Chemicals |
| 29 | Non-ferrous metal |
| 30 | Non-metallic minerals |
| 31 | Paper, pulp, printing |
| 32 | Food, beverage and tobacco |
| 33 | Textile and leather |
| 34 | Timber |
| 35 | Machinery and transport |
| 36 | Other industrial |
| 37 | Services |

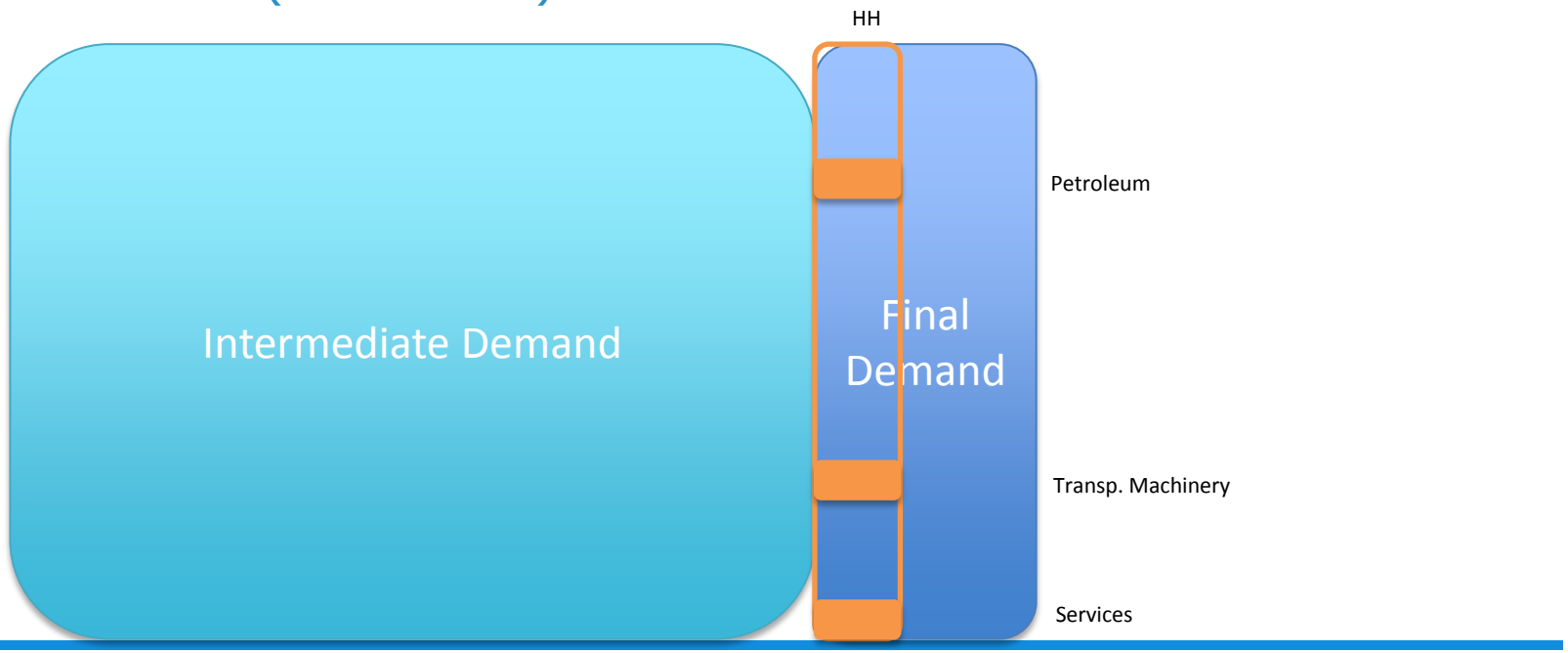
# Model


data
Reference I/O Table
1
Climate, Lifestyle
2
Building, Transport
3
Production, Manufacturing
4
Land, Water, Biodiversity
5
Electricity, Fossil Fuels
7
Transboundary, Trade
Modify Intermediate Demand
Intermediate and Labour demand from Firms min Cost
Modify Final demand
Labour supply from Household max Utility
Wages from market clearing
Output, Prices, Value Added and Employment

# How to use sectoral inputs?

## A few examples…

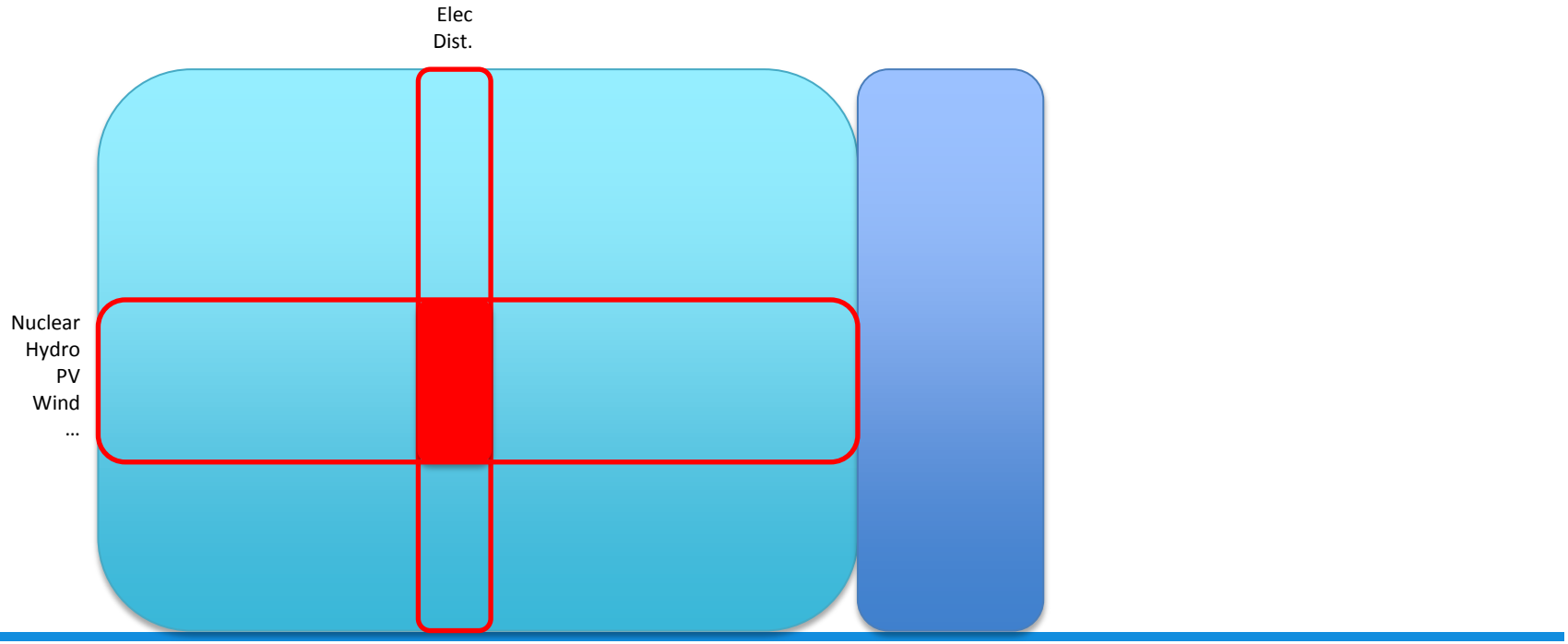
- Household car use: change in final demand of:
  - Petroleum products (gasoline purchase)
  - Transport machinery (purchase of cars)
  - Services (insurances)



# How to use sectoral inputs?

## A few examples…

- Electricity mix: change in intermediate demand of the electricity distribution sector



# Macroeconomic model

- Firms: Cost minimizers
  → Labour demand
- Consumers: max Utiliy(Consumption, Leisure)
  → Labour supply
- Labor market:
  - Unemployment: Search and matching model
- At the end, need to solve:
  - System of 3 non-linear equations to determine wages and price of capital
  - Linear system to get prices of good
  - Linear systems to get production and employment

→ Model of intermediate complexity

# Conclusion

- Collaboration between different fields necessary to assess impacts of energy transition and green policies
- Choice of method depends on objectives, data available, complexity required → No perfect model
- Possible to develop model of intermediate complexity
- Ongoing project: all comments welcomed!

- More information on EUCalc project:
  *http://www.european-calculator.eu*